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Portable Power Tiller

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ABSTRACT Indian agriculture is growing with tractors or cultivator machines for ploughing. Before this method farmers uses the traditional method, this is time consuming and hardworking and costly. In this paper a new portable power tiller is designed for farmers with very low cost. The available machines in the market is very high price and not affordable to farmers. So, this creation will solve the problem of Indian farmers. These machines increase the maximum weed removal capacity of the tiller blade in the new design. By adding some attachments to this machine will improve the maximum weed removal efficiency. This machine performs both tilling and crop cutting operation.

KEY WORDS: Ploughing, Design, Agriculture, Eco-friendly.

I.INTRODUCTION

In India currently farmers are unhappy to spend money for ploughing operation because of raise in petrol price day by day. To solve this problem, we made an electric power tiller and cutter machine which is power by battery to electric motor. The battery is ecofriendly and easily recharge. The power tiller is mainly used in farming operation for preparing a seedbed on upper level of land. The portable power tiller is not only the large soil mixing capacity compared to the other machine but also good weed cutting capability. In a market various power tiller machine is available and it is operated on internal-combustion engine. It running on engine the petrol or diesel is needed it is big problem, because this tiller machine creates a pollution in environment and it is dangerous for human health. To solve this problem we make this portable electric power tiller and cutter ma- chine. This is cost-effective and pollution free. In this portable electric power tiller we added some more useful accessories, which are wheel attachment and cutter attachment is used to cut the growed crop in soil and grass in gardening. For making farmers life comfortable during tilling work, earlier farmers were using Traditional farming method which is time consuming, hardworking and costly, hence we introduce new technology. Normally, the machines are used for the agricultural use in India which is of higher stage. All machines were used in farm are high price and not reasonable to farmers, hence to overcome this trouble we were make this model. This working model of power tiller is reducing man power &Rescuing the risk. This machine reduces the cost, improve the soil properties. This battery-operated power tiller reducing the use of fossil fuel and improving the productivity of agriculture.

II. SIGNIFICANCE OF THE SYSTEM

It is clear that tiller agriculture, for better productivity on the farms. The power tiller uses as follow -
1) Power tiller used for cultivation, sowing, weeding, and tillage. 2) It used with attachments that enhance its priority – sewing machine, Spray machine, router, and blood. 3) Further power tiller uses in Sugarcane farming, Rice cultivation, Wheat farming, and Paddy cultivation.
This newly developed tiller will be more useful for small farmers. The modern designing process, cost analysis and manufacturing process will responsible for affordable cost.

III. LITERATURE SURVEY

Agriculture has been an integral part of the human ecosystem. However, traditional farming methods require a lot of human effort and are very time-consuming. Farm tilling is one of the most labour-intensive operations in agriculture. Manual tiling of fields is very strenuous task while tractors incur high capital along with heavy fuel consumption costs.

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This low-cost portable battery charged electric power tiller machine is a one-stop modern solution to enhance the conventional agriculture methods of farming, as it reduces the human effort, at a very negligible price using motorized tilling mechanism. The electric power tiller helps reduce the time and cost involved in tilling using a smart portable design thereby increasing the productivity and efficiency in agriculture.

The Portable Electric Power Tiller delivers a load of advantages including:

1. Automatic Operation, 2. Battery Powered No Fuel Needed, 3. Portable and easy to operate, 4. Cost-effective as compared to a tractor, 5. Replacement for animal power & human effort, 6. Reduces tilling time

The machine makes use of a wheel with welded angles to provide efficient gripping on soil. The wheel design is developed to provide a firm grip on soil strong enough to drag the cultivator forks while tilling process. A switch provided on the handle is used to switch on off the machine. The machine is driven by an electric motor which uses a sprocket chain arrangement to drive the pulling wheel.

A battery is used to power the motor with a force capable of pulling the forks through soil. The 3 x cultivator forks allow for easy and narrow tilling exactly as needed for farming. The portable lightweight design makes it easy to control the direction of machine while in use. Also it can be easily carried around in vehicles or by hand for transporting the machine. Thus the electric power tiller provides a smart innovative fuel free mechanism to farm and garden tilling.

NC-41 Electric Portable Garden Tiller, Cultivator and Rotator is designed as a perfect garden tool for soil preparation, weeding and composting. It quietly, quickly and smoothly mix and pulverize the hard-packed soil in just one pass for loosening it to ensure maximum aeration and water seepage into the plant roots. No gas, oil or spark plugs means no hassle and low maintenance.

Features: - Easy and effective tiller cultivation with a powerful 1500 W motor. - 6 durable steel blades, the tiller will quickly and efficiently work through large surface areas. - Maximum working width of 45 cm - Maximum tilling depth of 22 cm - 2 point safety switch and overheat protection for safe operation. - 4 Steel tines each with 4 soil tilling blades will power through soil at the rate of 24 cuts per tines' revolution. - Developed for the keen DIY gardener, the high powered, high performance 4 x 4 garden tiller makes light work of keeping on top of your ground preparation. - Fitted with a heavy duty 1400 watt, 230v motor, this tiller takes away the 'back breaking' work of digging with a cutting width of 36 cm, maximum tilling depth of 22 cm and 4 durable steel blades, the tiller will quickly and efficiently work through large surface areas. Specifications: MODEL - NC-41E POWER: 1500 W POWER SUPPLY: ELECTRIC CUTTING WIDTH: 45 cm MAXIMUM TILLING DEPTH: 22 cm SPEED: 390 RPM SOUND LEVEL: 93 DECIBELS PRODUCT WEIGHT: 13.5 KG

Figure - 1

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IV. METHODOLOGY

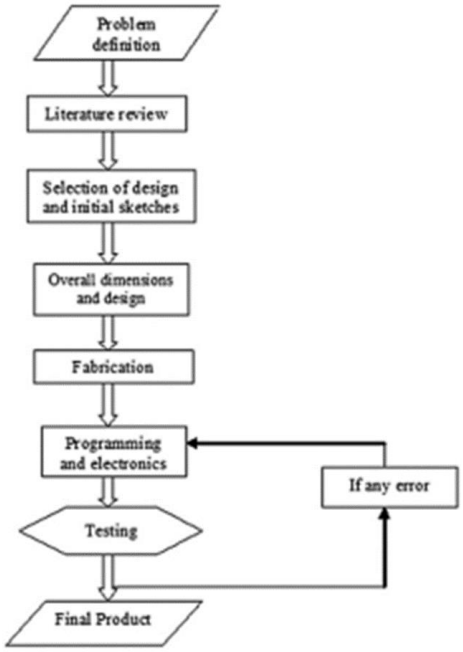

Figure - 2

DESIGN CALCULATION OF THE COMPONENT:

Total Load Assumed = 1000 N

Consider Euler's formula:

$L = \frac{500}{2}$ $l_e = \frac{L}{\sqrt{2}}$

=250 mm **=176.77mm**

P_E **= 500 N** **E = 200 Gpa** $= 200*10^3$ **N/mm**^{2}

Consider Euler's Theory: $P_E = \frac{\pi EI}{le}$, $500 = \frac{\pi*200*10^2*I}{176.77}$,

$I = \frac{500*176.77}{\pi*200*10^2}$

I = 7.915mm^4 **(I = least moment of inertia)**

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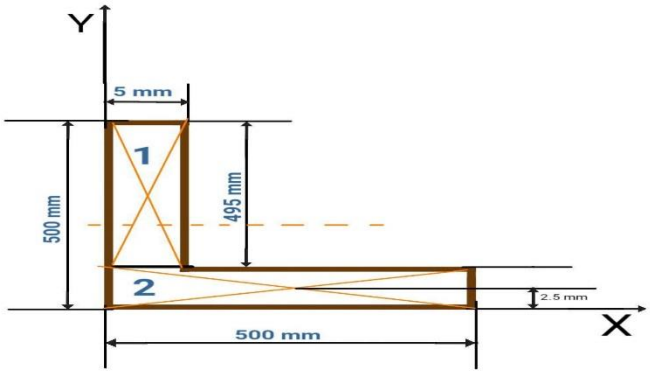

Figure – 3

$I_{XX}=I_1+I_2$

$I_1=I_{G_1}+a_1*h_1^2$ $\quad$ $I_2=I_{G_2}+a_2*h_2^2$

$=\frac{b*d^3}{12}+2475*(125.63)^2$ $\quad$ $=\frac{b*d^3}{12}+2500*(124.37)^2$

$=\frac{5*495^3}{12}+2475*(125.63)^2$ $\quad$ $=\frac{500*5^3}{12}+2500*(124.37)^2$

$=89599076.08$ $\quad$ $=38674950.58$

$\therefore I_{XX}=I_1+I_2$ $\quad =89599076.08+38674950.58$ $\quad =128274026.7$ mm^4 **(Safe)**

MATERIALS COST ANALYSIS:

Sl. No.	Name of items	Units	Qty	Rate	Amount
1.	M.S. box materials	ft.	14	50	700
2.	L- Section material	ft.	15	50	750
3.	Sheet Metal	meter	1	200	200
4.	Shaft	Pcs	1	80	80
5.	Electric Hub Motor(250 W)	Hp	1	2,500	2,500
6.	Controller	Watt	1	5,00	500
7.	Battery (12 Volt)	Volt	2	1,500	3,000
8.	Wheel Rim	Pcs	1	100	100
9.	Chain, Sprocket & Bearing	-	-	120	120
10.	Workshop Equipment's	-	-	-	150
11.	Nut & Bolt, Washer	Pcs	-	30	30
12.	Paint (BLACK)	-	2	100	200
Total cost					8330

Table – 1

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V. EXPERIMENTAL RESULTS

Portable Power Tiller manufactured by Students:

Figure 4

VI. CONCLUSION AND FUTURE WORK

The power tiller is most suited for usage in hilly locations, moist conditions, and on small farms because it can do both primary and secondary tillage operations. The power tiller, with the correct set of tools and attachments, can handle most of the field operations in intensive cultivation. The power tiller's small weight makes it ideal for working in both wet and dry situations. Depending on the type of work, external attachments can be added to the tiller. As a result, the tiller can be utilized for a variety of tasks.

Indian small farmers can afford this portable power tiller. There are a lot of future scope for researchers.

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Presently working as Lecturer in Mechanical Engineering Department at Technique Polytechnic Institute, Panchrokhi, Sugandhya, Dist. Hooghly, West Bengal, India since August 2012. Earlier he worked as lecturer in Mechanical Engineering Department at Kingston Polytechnic College, Barasat, Kolkata, West Bengal, India He started his career in academic line as Part Time Lecturer at I.C.V. Polytechnic, Jhargram, West Bengal, India from 2001. Earlier to that have a working experience at Automobile Industry more than 6 Years.

He is in the academic arena for last 22 years having lots of publication at national and international Journals and Conferences. His area of interest is Engineering Materials, Automobile Engineering, Fluid Mechanics & Fluid Power, Machine Design and Industrial Engineering.